Geoscientific Model Development 2013 vol.6 N5, pages 1745-1765

Scheme for calculation of multi-layer cloudiness and precipitation for climate models of intermediate complexity

Eliseev A., Coumou D., Chernokulsky A., Petoukhov V., Petri S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

In this study we present a scheme for calculating the characteristics of multi-layer cloudiness and precipitation for Earth system models of intermediate complexity (EMICs). This scheme considers three-layer stratiform cloudiness and single-column convective clouds. It distinguishes between ice and droplet clouds as well. Precipitation is calculated by using cloud lifetime, which depends on cloud type and phase as well as on statistics of synoptic and convective disturbances. The scheme is tuned to observations by using an ensemble simulation forced by the ERA-40-derived climatology for 1979-2001. Upon calibration, the scheme realistically reproduces basic features of fields of cloud fractions, cloud water path, and precipitation. The simulated globally and annually averaged total cloud fraction is 0.59, and the simulated globally averaged annual precipitation is 100 cm yr?1. Both values agree with empirically derived values. The simulated cloud water path is too small, probably because the simulated vertical extent of stratiform clouds is too small. Geographical distribution and seasonal changes of calculated cloud fraction and precipitation are broadly realistic as well. However, some important regional biases still remain in the scheme, e.g. too little precipitation in the tropics. We discuss possibilities for future improvements in the scheme.

http://dx.doi.org/10.5194/gmd-6-1745-2013